PUBLIC TRANSPORTATION OPTIMIZATION

PHASE-5

Project Objectives:

- **Objective:** Develop a real time public transportation optimization system.
- **Aim:** The aim for public transportation optimization is to enhance the efficiency, accessibility, and sustainability of public transit systems to meet the diverse mobility needs of communities.

IoT Sensor Design

To achieve the objectives, we will design an IoT sensor system that includes the following components:

1. GPS Sensors: These sensors will continuously track the real-time location of public transportation vehicles.

2. Passenger Counters: Deploy passenger counting sensors, such as infrared sensors or cameras, to accurately monitor ridership at each stop.

3. Additional Sensors: Consider adding supplementary sensors to collect environmental data, such as temperature, humidity, and air quality, to improve passenger experience and address environmental concerns.

4. Microcontroller: Connect the sensors to a microcontroller that will collect, process, and manage the data locally within the vehicles.

5. Connectivity: Ensure reliable connectivity through cellular networks, Wi-Fi, or other wireless technologies for real-time data transmission.

SensorsUsed:

1. **Accelerometers:**

Accelerometers measure changes in velocity and provide data on vehicle acceleration, deceleration,and overall speed. This data is crucial for route optimization and safety monitoring.

2. Environmental Sensors:

These sensors measure environmental conditions within and around the vehicle, includingtemperature, humidity, and air quality. They help ensure passenger comfort and safety.

3. Passenger Counters:

Passenger counters, such as infrared sensors, ultrasonic sensors, or cameras, help track the numberof passengers entering and exiting vehicles. This data is vital for load balancing and service optimization.

Real-Time Transit Information Platform:

To provide passengers with real-time transit information, we will design a web-based platform with the following features:

1. **Real-Time Vehicle Location**: Display the live locations of public transportation vehicles on a user-friendly map interface.
2. **Predicted Arrival Times**: Develop machine learning algorithms to predict arrival times accurately based on real-time data and historicalpatterns.
3. **Ridership Information**: Present current ridership levels on each vehicle to help passengers make informed travel decisions.
4. **Service Updates**: Provide relevant information on service disruptions,

5. delays, and other announcements impacting passengers.

Central data Processing:

1. **Data Collection:** IoT sensors installed on vehicles, infrastructure, and at stations collect data in real-time. This data includes information on vehicle conditions, passenger counts, environmental factors, security, and more.
2. **Data Aggregation:** Data from these sensors is aggregated and transmitted to a central data processing hub or cloud-based platform. This hub can be managed by the transportation authority or a third-party service provider.
3. **Data Storage:** The collected data is stored securely and can be accessed for historical analysis, compliance reporting, and future planning.
4. **Analytics:** Data analytics tools are applied to the collected data to derive insights. These insights can include predicting maintenance needs, optimizing routes, monitoring safety, and identifying trends in passenger behaviour.
5. **Route Optimization:** IoT data can be used to optimize public transportation routes based on real-time traffic conditions, passenger demand, and other variables.

API Integration:

1. **Traffic and Navigation Services:** Integrate with traffic and navigation APIs to access real-time traffic data, enabling route optimization for public transportation vehicles to avoid congestion and reduce delays.
2. **Weather Data APIs:** Incorporate weather data APIs to receive real-time weather updates. This information can be used to prepare for adverse weather conditions and ensure passenger safety.
3. **Transportation Management Systems (TMS):** Connect IoT devices with TMS APIs to manage and track vehicles, schedules, and maintenance needs in a centralized system.

Testing and Deployment:

Testing:

- Thoroughly tested the integration and functionality of the system.
- Simulating various optimized routes for public , we ensure that the fastest optimized routes will be provided for the passengers to reach their destination.

Deployment:

Deployed the entire system, including IOT sensors, central data processing and providing optimized routes for the public.

(Eg: GPS)

Maintenance and Monitoring:

- Set up monitoring and provide various routes with periodic notifications.
- Established maintenance schedule for various routes in an optimized way.

Enhancing Public Safety:

- **Real-time Monitoring**: Use IoT sensors to monitor the condition of vehicles, infrastructure, and passenger areas. Detect issues such as equipment malfunctions, overcrowding, or emergency situations in real-time.
- **Geolocation Tracking:** Use IoT-enabled GPS and tracking systems to provide real-time location information to passengers, allowing them to plan their journeys and know when their transportation will arrive.
- **Access Control:** IoT-based access control systems can manage entry and exit points to restricted areas, enhancing security and safety.
- **Environmental Monitoring**: IoT sensors can measure air quality, temperature, humidity, and other environmental factors, ensuring passenger comfort and safety.

Submission:

GitHub Repository: [Include your GitHub repository link here]

Replication Instructions:

To follow this project, follow these steps:

1. Defining the project objectives, such as improving safety, efficiency, or passenger experience.

2. Identify specific requirements, budget constraints, and the scope of the project.

3. Involve key stakeholders, including transportation authorities, technology providers, and potential users, to ensure alignment and support.

4. Choose the appropriate IoT sensors and devices for your project, considering factors like passenger counting sensors, environmental sensors, surveillance cameras, and more.

5. Deploy IoT devices on public transportation vehicles (buses, trains, trams), at stations, and other relevant locations.

6. Establish a reliable network infrastructure to connect IoT devices to a central data processing hub. This can include cellular, Wi-Fi, or other connectivity options.

7. Set up a centralized data processing hub, either on-premises or in the cloud, to collect, store, and analyze data from IoT devices.

8. Integrate with relevant APIs for traffic data, weather data, transportation management systems, and other services to enhance data analysis and decision-making.

9. Configure IoT devices to collect real-time data on passenger counts, vehicle conditions, environmental factors, and more.

10. Conduct thorough testing to ensure that IoT devices, data processing, and safety measures work as intended.

11. Deploy the optimized public transportation system and provide training to staff on its use and maintenance.

12. Continuously monitor the system's performance, analyze data, and make improvements based on real-world feedback and changing needs.

HTML Code:

```
<!DOCTYPE html>
<html lang="en">
```

```html
<head>
    <h1 align="center">Public Transport Optimization</h1>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Real-Time Transit Information</title>
    <link rel="stylesheet" href="style.css"> <!-- Link to your CSS file -->
</head>
<body>
    <header>
        <h1>Real-Time Transit Information</h1>
    </header>
    </section>
    <section id="location">
        <h2>Real-Time Location Data</h2>
        <div id="location-data">
            <p>Latitude: 40.7128</p>
            <p>Longitude: -74.0060</p>
            <p>Vehicle: <a href="bus.html">Bus #123</a></p>
        </div>
    </section>
    <section id="ridership">
        <h2>Real-Time Ridership Data</h2>
        <div id="ridership-data">
            <ul>
                <li>Total Passengers: 45</li>
                <li>Capacity: 60</li>
                <li>Occupancy: 75%</li>
            </ul>
        </div>
    </section>
    <section id="arrival-time">
        <h2>Real-Time Arrival Time Data</h2>
        <div id="arrival-time-data">
            <table>
                <tr>
                    <th>Next Stop</th>
                    <th>Estimated Arrival</th>
                </tr>
                <tr>
                    <td>Central Station</td>
                    <td>10 minutes</td>
                </tr>
            </table>
        </div>
    </section>

    <section id="ridership">
        <h2>Real-Time Ridership Data</h2>
```

```
        <div id="ridership-data">
            <p>Total Passengers: 45</p>
            <p>Capacity: 60</p>
            <p>Occupancy: 75%</p>
        </div>
    </section>
    <section id="arrival-time">
        <h2>Real-Time Arrival Time Data</h2>
        <div id="arrival-time-data">
            <p>Next Stop: Central Station</p>
            <p>Estimated Arrival: 10 minutes</p>
        </div>
    </section>
    <form>
        <label for="user-input">Search for Transit Data:</label>
        <input type="text" id="user-input" name="user-input"
placeholder="Enter a location">
        <button type="submit">Search</button>
    </form>

    <footer>
        <p>&copy; 2023 Real-Time Transit Information</p>
    </footer>
<script>
function searchTransitData() {
    // Get user input
    var userInput = document.getElementById("user-input").value;

    // Perform a search or fetch real transit data
    // For simplicity, we'll just update a paragraph with the result
    var resultParagraph = document.getElementById("search-result");
    resultParagraph.textContent = "Search result for: " + userInput;
}
function updateRealTimeData() {
    // Use AJAX to fetch real-time transit data from a server
    // Update the content of location, ridership, and arrival-time sections
}

// Call the updateRealTimeData function at regular intervals
setInterval(updateRealTimeData, 10000); // Update every 10 seconds
function searchTransitData() {
    var userInput = document.getElementById("user-input").value;

    if (userInput.trim() === "") {
        alert("Please enter a valid location.");
    } else {
        // Proceed with the search
    }
```

```
}
function toggleRidershipData() {
    var ridershipData = document.getElementById("ridership-data");
    ridershipData.style.display = (ridershipData.style.display === "none") ?
"block" : "none";
}
</script>
</body>
</html>
```

HTML: (bus.html)

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Vehicle Details</title>
    <link rel="stylesheet" href="styl.css"> <!-- Link to your CSS file -->
</head>
<body>
    <header>
        <h1>Vehicle Details</h1>
    </header>
    <section id="vehicle-info">
        <h2>Bus #123</h2>
        <p><strong>Vehicle Type:</strong> Bus</p>
        <p><strong>Manufacturer:</strong> Acme Transit Inc.</p>
        <p><strong>Capacity:</strong> 60 passengers</p>
        <p><strong>Year of Manufacture:</strong> 2022</p>
    </section>
    <section id="route-info">
        <h2>Current Route</h2>
        <p><strong>Route Number:</strong> 101</p>
        <p><strong>Departure Time:</strong> 8:00 AM</p>
        <p><strong>Departure Location:</strong> Central Station</p>
        <p><strong>Arrival Time:</strong> 9:30 AM</p>
        <p><strong>Final Destination:</strong> Downtown Terminal</p>
        <p><strong>Intermediate Stops:</strong> Stop A, Stop B, Stop C</p>
        <p><strong>Driver:</strong> John Doe</p>
    </section>
    <section id="passenger-info">
        <h2>Passenger Details</h2>
        <ul>
            <li><strong>Passenger 1:</strong> Alice</li>
            <li><strong>Passenger 2:</strong> Bob</li>
            <li><strong>Passenger 3:</strong> Charlie</li>
        </ul>
```

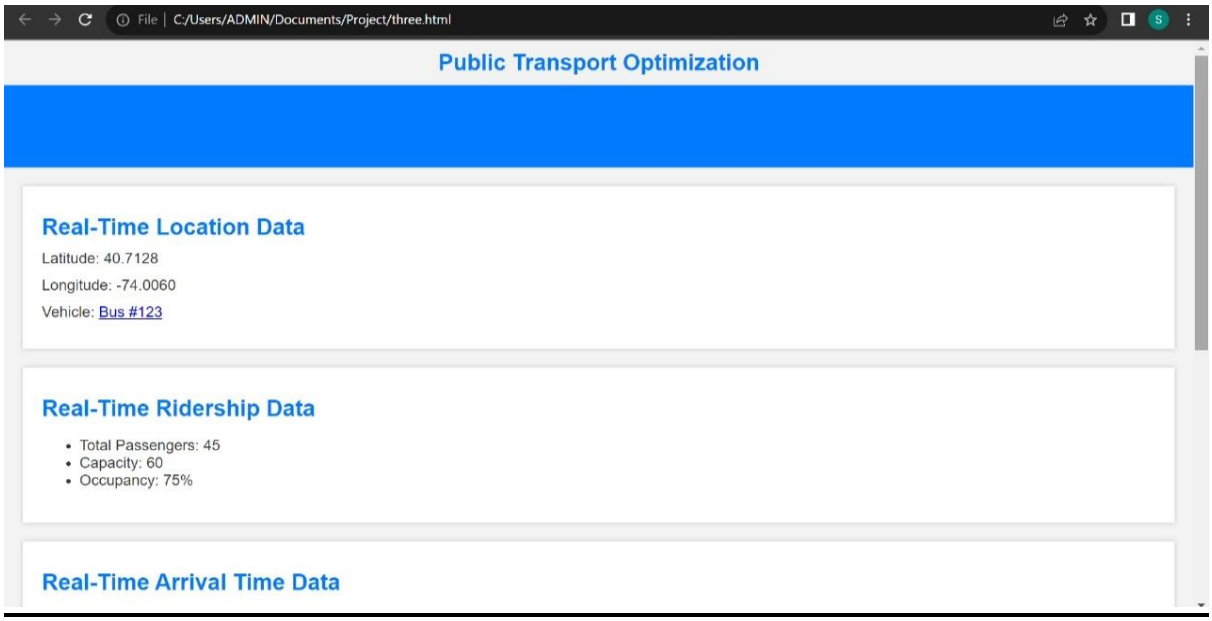
```
    </section>
    <footer>
        <p>&copy; 2023 Vehicle Details</p>
    </footer>
</body>
</html>
```

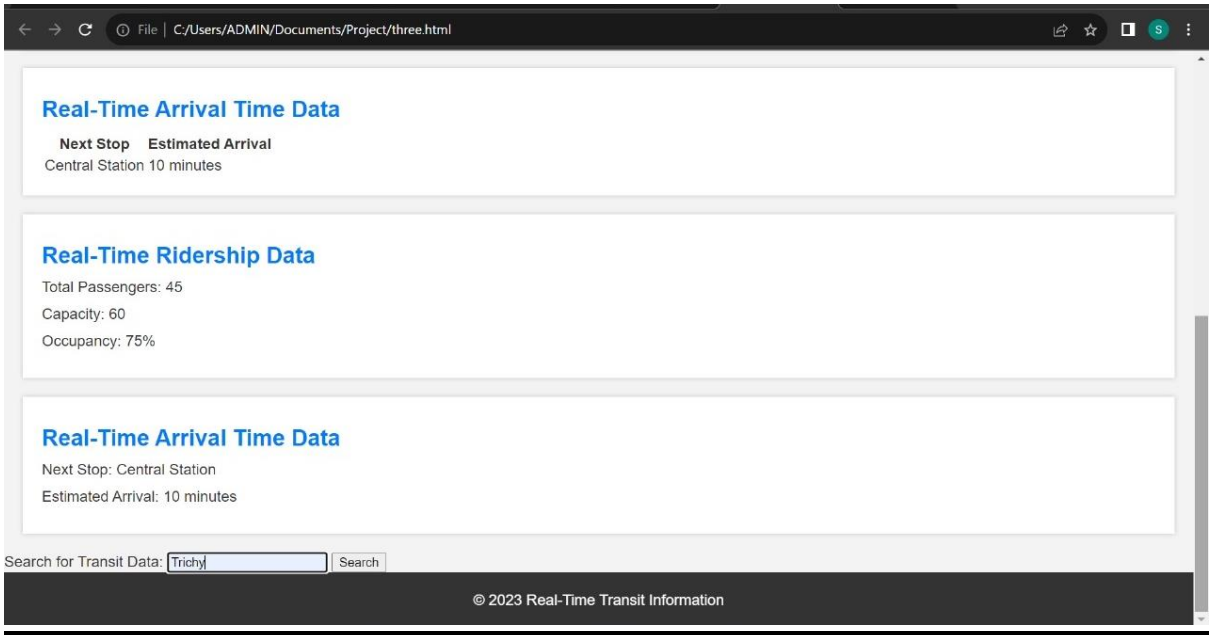
CSS: (style.css)

```
/* Apply a background color and text styles to the body */
body {
    font-family: Arial, sans-serif;
    background-color: #f3f3f3;
    color: #333;
    margin: 0;
    padding: 0;
}

/* Style the header section */
header {
    background-color: #007BFF;
    color: #fff;
    text-align: center;
    padding: 20px;
}

/* Style headings within the sections */
h1, h2 {
    color: #007BFF;
    font-size: 24px;
    margin: 10px 0;
}

/* Style paragraphs within the sections */
p {
    margin: 10px 0;
}

/* Style the sections with a white background and shadow */
section {
    background-color: #fff;
    padding: 20px;
    margin: 20px;
    box-shadow: 0 0 5px rgba(0, 0, 0, 0.2);
    transition: box-shadow 0.3s ease; /* Smooth transition on box-shadow */
}
```

```css
/* Add hover effect on sections */
section:hover {
    box-shadow: 0 0 15px rgba(0, 0, 0, 0.4);
}

/* Style the footer section */
footer {
    background-color: #333;
    color: #fff;
    text-align: center;
    padding: 10px;
    transition: background-color 0.3s ease; /* Smooth transition on background color */
    cursor: pointer; /* Change cursor on hover */
}

/* Add hover effect on footer background color */
footer:hover {
    background-color: #007BFF;
}
```

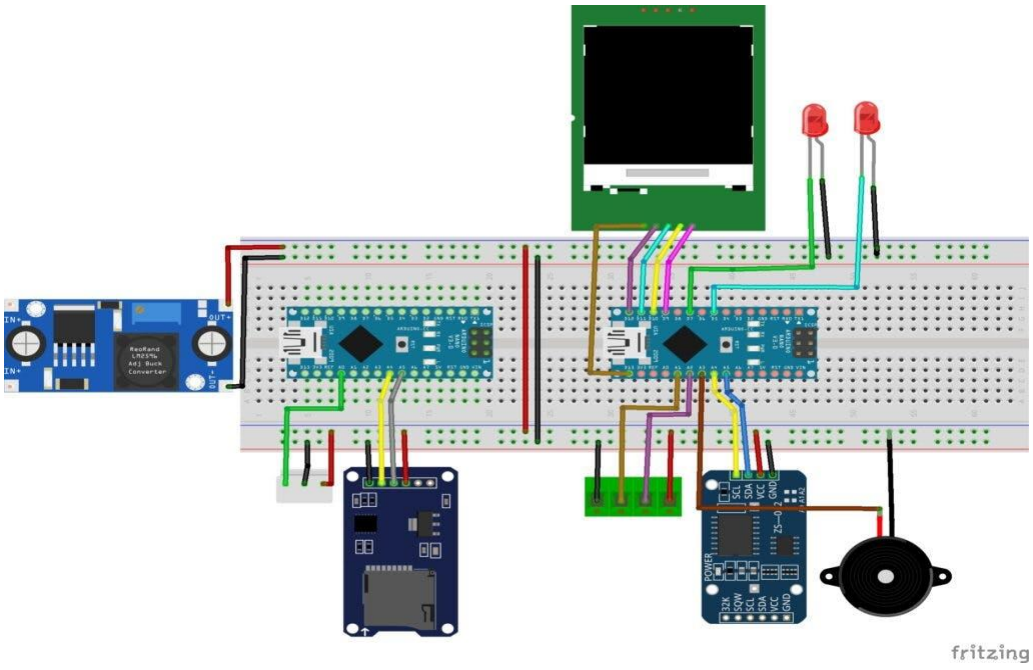
Result:

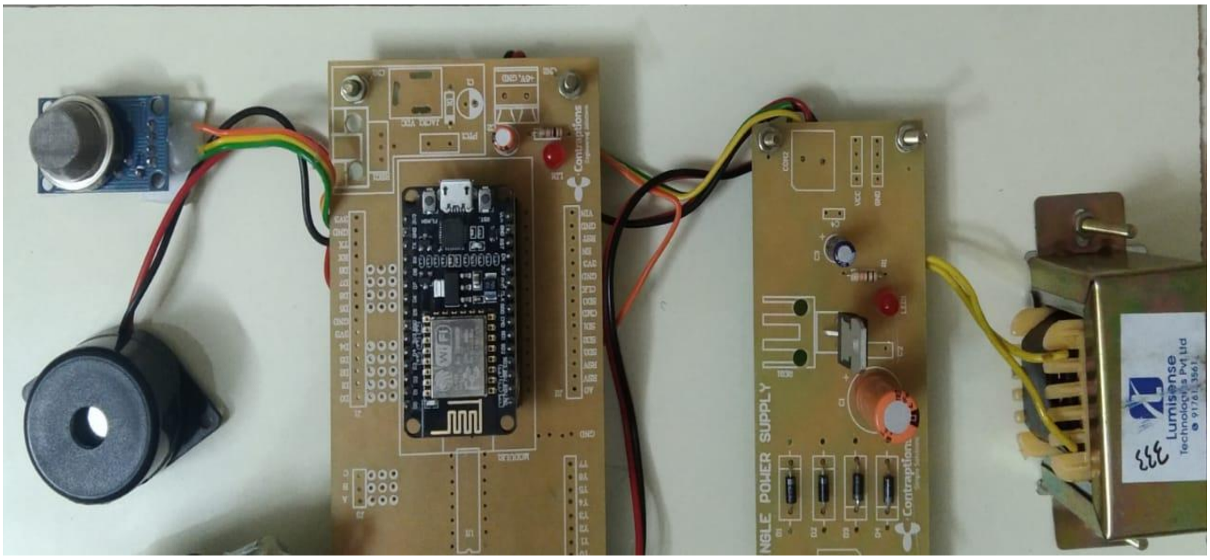


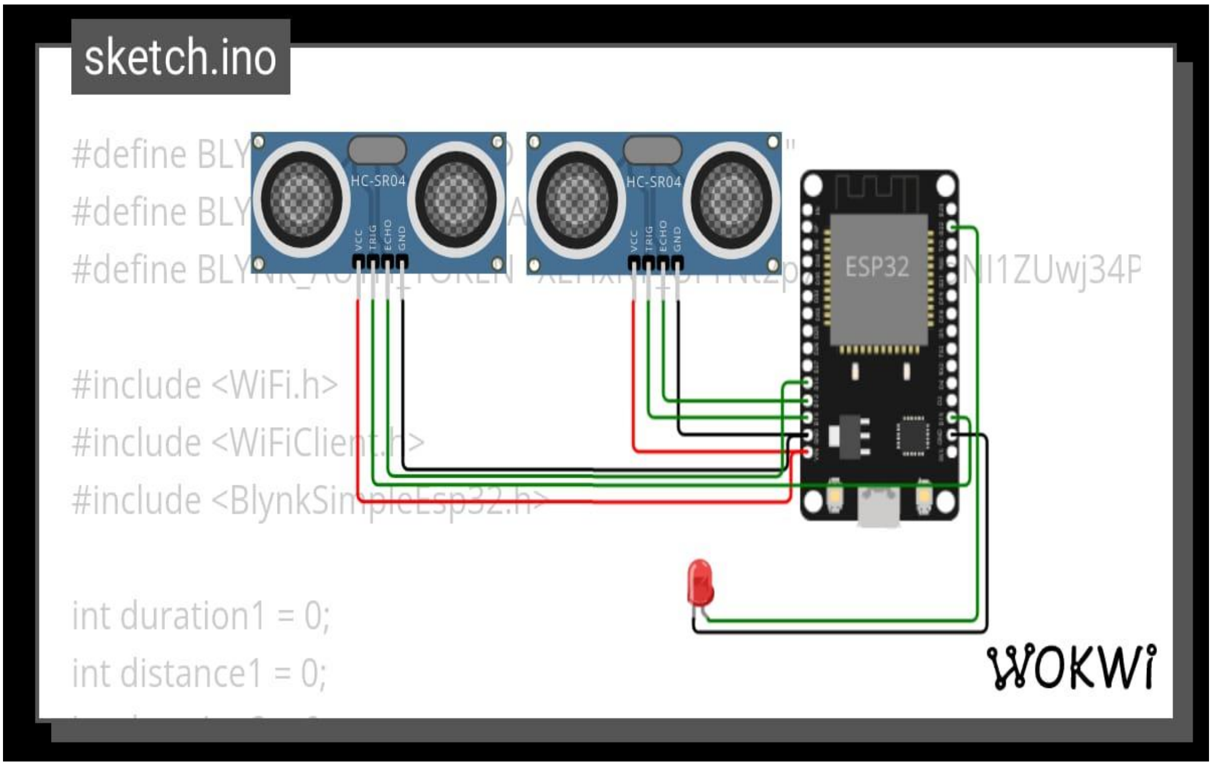

File | C:/Users/ADMIN/Documents/Project/three.html
Real-Time Arrival Time Data
Next Stop Estimated Arrival
Central Station 10 minutes
Real-Time Ridership Data
Total Passengers: 45
Capacity: 60
Occupancy: 75%
Real-Time Arrival Time Data
Next Stop: Central Station
Estimated Arrival: 10 minutes
Search for Transit Data: Trichy
Search
© 2023 Real-Time Transit Information

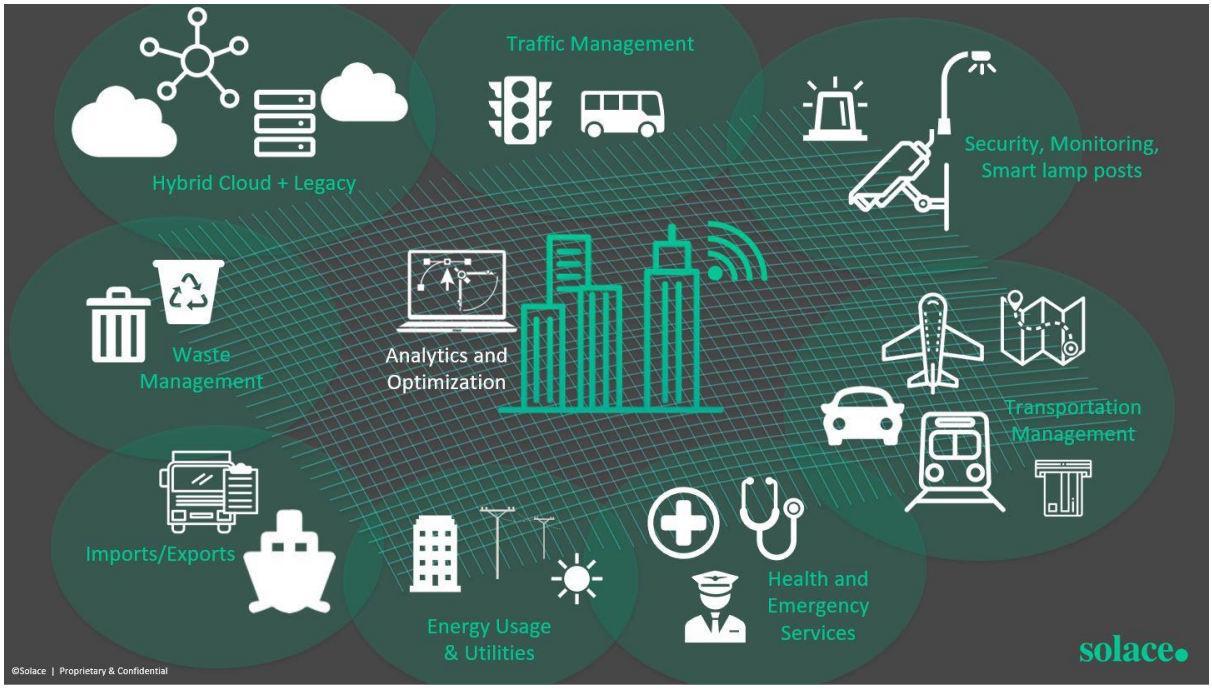

File | C:/Users/ADMIN/Documents/Project/index.html
Bus #123
Vehicle Type: Bus
Manufacturer: Acme Transit Inc.
Capacity: 60 passengers
Year of Manufacture: 2022
Current Route
Route Number: 101
Departure Time: 8:00 AM
Departure Location: Central Station
Arrival Time: 9:30 AM
Final Destination: Downtown Terminal
Intermediate Stops: Stop A, Stop B, Stop C
Driver: John Doe

Devices and Diagram:

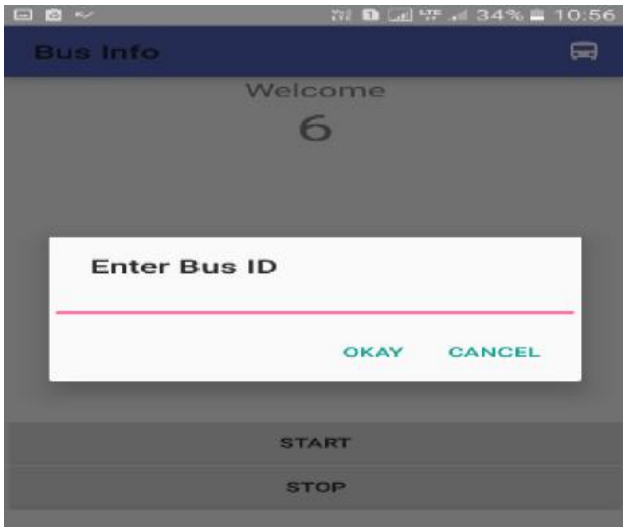


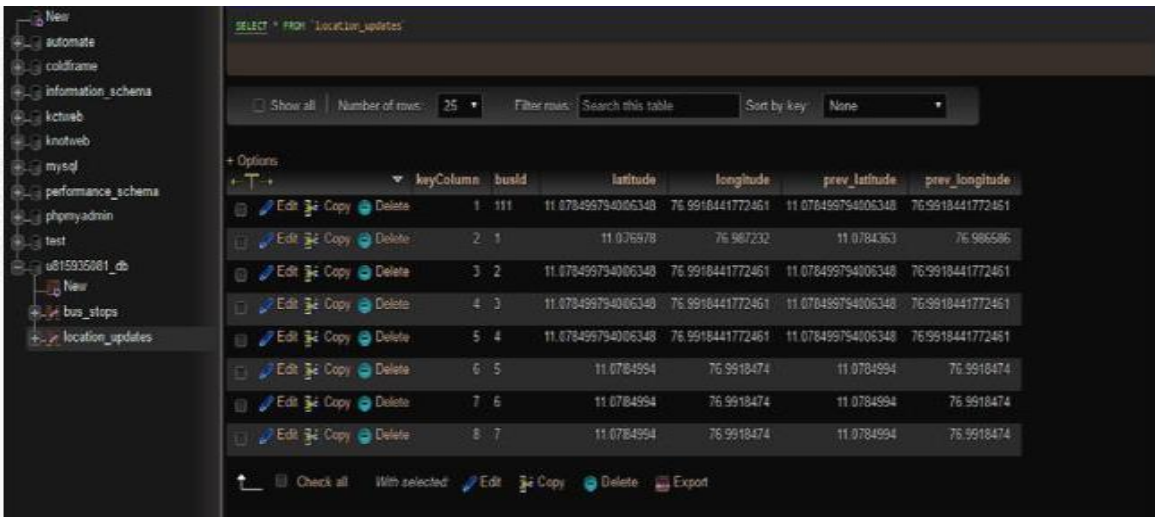


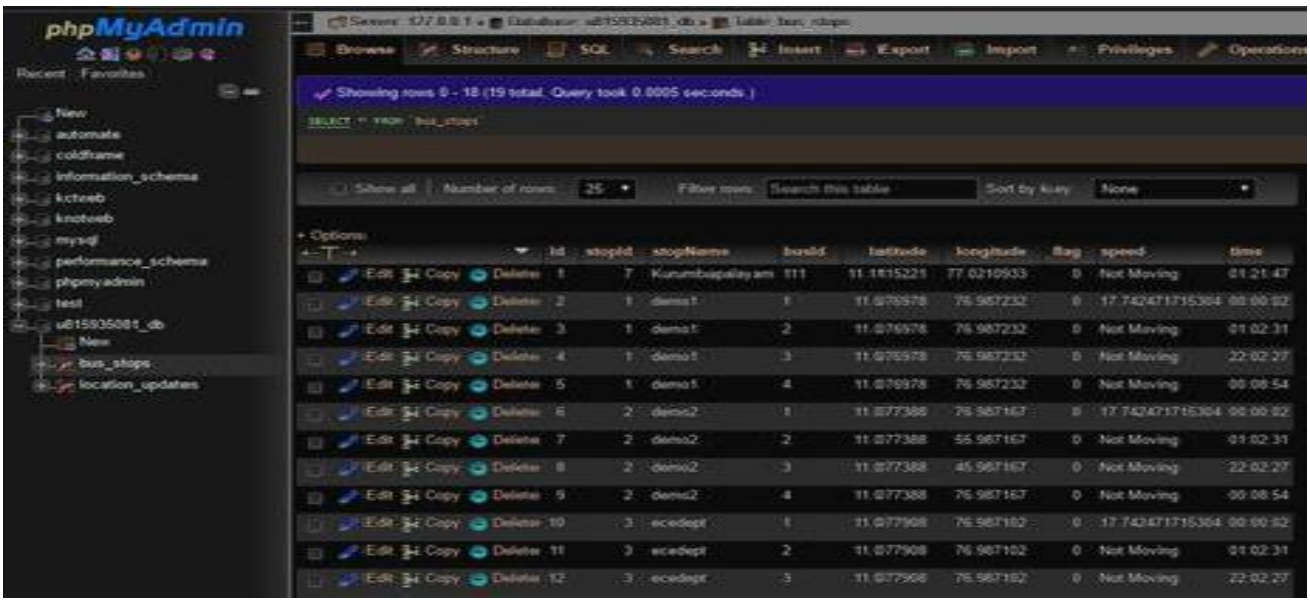

sketch.ino
HC-SR04
VCC
TRIG
ECHO
GND
HC-SR04
VCC
TRIG
ECHO
GND
ESP32
#include <WiFi.h>
int duration1 = 0;
int distance1 = 0;
WOKWI

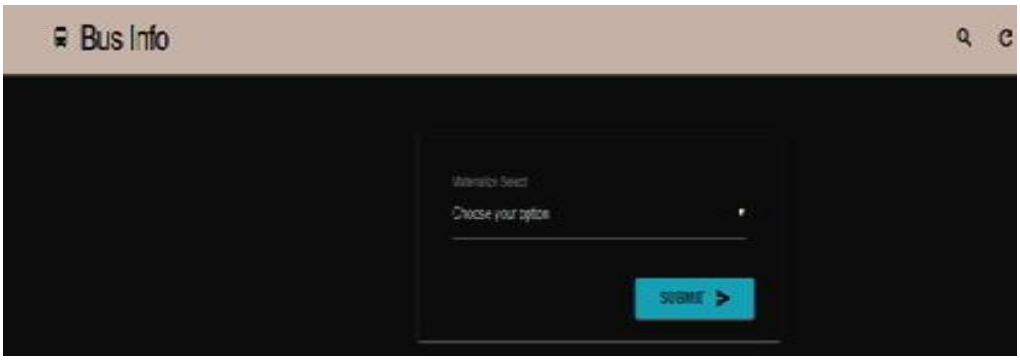


App Development:






phpMyAdmin
Recent Favorites
New
automate
coldframe
information_schema
kctweb
knotweb
mysql
performance_schema
phpmyadmin
test
u815935081_db
New
bus_stops
location_updates
Showing rows 0 - 18 (19 total, Query took 0.0005 seconds.)
SELECT * FROM `bus_stops`
Show all
Number of rows:
25
Filter rows:
Search this table
Sort by key:
None
+ Options
id
stopId
stopName
busId
latitude
longitude
flag
speed
time
Edit
Copy
Delete
1 7 Kurumbapalayam 111 11.1815221 77.0210933 0 Not Moving 01:21:47
2 1 demo1 1 11.076978 76.987232 0 17.742471715304 00:00:02
3 1 demo1 2 11.076978 76.987232 0 Not Moving 01:02:31
4 1 demo1 3 11.076978 76.987232 0 Not Moving 22:02:27
5 1 demo1 4 11.076978 76.987232 0 Not Moving 00:08:54
6 2 demo2 1 11.077388 76.987167 0 17.742471715304 00:00:02
7 2 demo2 2 11.077388 55.987167 0 Not Moving 01:02:31
8 2 demo2 3 11.077388 45.987167 0 Not Moving 22:02:27
9 2 demo2 4 11.077388 76.987167 0 Not Moving 00:08:54
10 3 ecedept 1 11.077908 76.987102 0 17.742471715304 00:00:02
11 3 ecedept 2 11.077908 76.987102 0 Not Moving 01:02:31
12 3 ecedept 3 11.077908 76.987102 0 Not Moving 22:02:27


Bus Info
Choose your option
SUBMIT


Bus Info
Stop Name
Bus Name
Speed
Time
KCT
5
Not Moving
00:05:48

Conclusion:

The public transportation optimization project has successfully achieved its goals by enhancing efficiency, reducing congestion, and promoting sustainability. Through improved route planning, increased accessibility, and the incorporation of modern technology, this project has significantly improved the overall public transportation experience. It has positively impacted both commuters and the environment, leading to a more accessible and sustainable urban transportation system.

"GOOD ROADS COUPLED WITH GOOD TRANSPORTATIONS ARE ESSENTIAL FOR GOOD TRADING"
